

CHAPTER 7 SEISMIC SAFETY RETROFIT

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CHAPTER 7 SEISMIC SAFETY RETROFIT

7.1 INTRODUCTION

The Seismic Safety Retrofit Program was established by emergency legislation (SB 36X) enacted during an extraordinary legislative session called after the Loma Prieta earthquake occurred in October 1989. The purpose of the Seismic Safety Retrofit Program is to provide funding assistance for remedying structural seismic design deficiencies of public bridges in California. (There are about 12,000 State and 12,000 local bridges in the State.) A local component of this program provides assistance to cities and counties for funding bridge seismic retrofit projects on local streets and roads bridges.

The Director of Caltrans has set top priority for the mandated Seismic Safety Retrofit Program.

7.2 PROGRAM FUNDING

ISTEA FUNDING FOR SEISMIC RETROFIT & HBRR PROGRAMS

The 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) provided an increased level of funding for HBRR program from previous years. HBRR funds will be used to finance the seismic program. This may delay the delivery of HBRR projects.

Local bridge retrofit projects developed under the mandated Seismic Safety Retrofit Program (as defined below) are funded with a combination of Federal (88.53 percent) and State (11.47 percent) funds. All work to be funded through the local HBRR with State providing the match. Work can include consultant selection, seismic analysis leading to strategy, environmental, right of way, PS&E, construction, construction inspection and local agency overhead. Therefore, there should be no cost to the local agency, except for up-front progress payments prior to Federal and State reimbursement.

7.3 PROJECT ELIGIBILITY

This mandated Seismic Safety Retrofit Program is limited to those bridges that are determined to be Category 1, bridges that may collapse in a seismic event and potentially threaten public safety.

(See Chapter 11 "HBRR", for information on the "voluntary" seismic retrofit program which is funded by the Highway Bridge Replacement and Rehabilitation (HBRR) Program for bridges not in Category 1.)

SCREENING BRIDGES

At the outset of the Local Seismic Safety Retrofit Program, all local bridges were considered candidates for retrofitting. A series of three screenings of local bridges was then performed by Caltrans' Division of Structures to determine if further seismic analysis was needed. The screening processes utilized the as-built plans and a risk algorithm called the ranking factor. These screenings resulted in 1,094 bridges remaining in the Seismic Safety Retrofit Program.

Factors considered during screening included

- proximity to earthquake faults
- age and date of construction
- soil conditions (depth and type) found at the site
- number of columns
- length
- ADT
- type of route
- type of facility crossed
- skew
- outriggers
- joints
- number and type of hinges
- length of available detour

7.4 ELIGIBLE COSTS

All local agency costs (including direct and agency overhead) which are directly attributable and/or properly allocable to the specific seismic safety project, designated by Caltrans, are eligible for reimbursement.

To be reimbursed, local agencies are to follow the standard procedure outlined in Chapter 3, "Project Authorization", Chapter 5, "Accounting/Invoices" and Chapter 15, "Advertise/Award Project" in the *Local Assistance Procedures Manual*, except as noted below.

7.5 ROLES AND RESPONSIBILITIES

LEAD AGENCIES

The lead agency shall inspect all publicly owned bridges for which it is the lead agency and shall assess the need for seismic retrofit work. For each bridge which is determined that seismic structural deficiencies exist, the lead agency shall develop a retrofit project.

In the beginning of the program, three lead agencies were designated in the program as follows:

CALTRANS is the lead agency for all local seismic retrofit projects in all counties in California, except Los Angeles County and the unincorporated portion of Santa Clara County.

LOS ANGELES COUNTY was designed lead agency for local bridge retrofit projects in Los Angeles County, and was responsible for all project development activities for local seismic safety retrofit projects within all the cities in Los Angeles County except State bridges.

SANTA CLARA COUNTY, was designated as a lead agency for local bridge retrofit projects located within the unincorporated portion of the county except State bridges..

Later on in the program several cities and counties assumed responsibility (Caltrans still remained as lead agency) for the seismic safety retrofit of the bridges in their area.

Projects were developed by each lead agency using the information gathered during the screening phase and other criteria established by the lead agencies. Other criteria included the critical nature of the facility to the community, and additional work required by use of HBRR funds. Screening identified about 1,100 local bridges requiring further analysis.

Total local retrofit program = 1,094 Bridges (as of March 1, 1996).

Caltrans lead agency for 792.

Los Angeles County lead agency for 272.

Santa Clara County lead agency for 30.

Note: Number will continue to change as bridges are added or dropped through further analyses.

PROGRAMMING OF SEISMIC PROJECTS

All projects must be included in the most-currently-approved Federal Statewide Transportation Improvement Program (FSTIP) as an individual project or a lump sum listing before Federal funds can be authorized for a project.

To save each local agency and RTPA from trying to determine the amount to program in the FSTIP for each seismic retrofit project, Caltrans has instructed each MPO to include a blanket amount in their FTIPs for seismic and HBRR. In non-MPO areas, Caltrans has programmed these blanket amounts.

7.6 DESIGN STANDARDS

“The primary philosophy for the retrofit program is to prevent collapse. The primary strategy to do this is to fully retrofit one bent (column/footing unit) per frame or bridge. However, the designer may demonstrate by analysis that collapse can be avoided without doing any retrofit. This type of “do nothing” strategy is an acceptable assessment. The designer must be cautioned to follow all load path demands and assure that no one portion of the resisting structural frame is deficient.” - excerpt from Caltrans’ Structures *Memo to Designers 20-4*.

In addition to design standards and reference in Chapter 11, “Design Standards” in the *Local Assistance Procedures Manual*, the following design standards and references are available to those involved in seismic design:

1. Bridge Manuals: *Bridge Design Manual* -modified AASHTO specifications
Bridge Memo to Designers
Bridge Design Details
Bridge Design Aids

including: Bridge Memo To Designers 20-4, March 1995 - Caltrans Bridge Retrofit Procedures

2. Seismic Design References - Excerpts from the Caltrans Division of Structures technical manuals compiling Seismic Design Requirements.

3. Various publications of design notes and research results by the University of California at Berkeley, San Diego and others. These are used extensively in current practice and enable the industry to keep up with the very latest research results. These research projects are listed in Bridge Memo To Designers 20-4.

4. Various computer programs have been developed by Caltrans' personnel that ease the analysis and calculations required in retrofit analysis. These are made available to consultants and local agencies involved in retrofit design.

Programs:	Beams304	Col604n	Col702r	Frame407
	NFoot	WFrame	XSection	

5. The Division of Structures has Standard Special Provisions available on the Internet located under the Caltrans Engineering Service Center homepage. The Internet site can be accessed via the following methods:

World Wide Web at: <http://tresc.dot.ca.gov>

FTP at: [trescftp.dot.ca.gov](ftp://trescftp.dot.ca.gov)

References mentioned above that are not available through Caltrans' Publication Distribution Unit are available through Caltrans' Structures Local Assistance Office at 916-227-8038.

METRIC

Where Caltrans is the lead agency for seismic design projects, the projects will be in English units and will utilize the Caltrans' *July 1992 Standard Plans and Specifications*. The local agency will be required to use English units on their roadway portion of these projects.

Since the NHS Act delayed the metric deadline to the year 2000, local agencies may use either metric or English units on their projects if they are doing seismic design. Caltrans has published the *July 1995 Standard Plans and Specifications* in metric. Caltrans will no longer produce any new publications in English units, although the *July 1992 Standard Plans and Specifications* are still available.

Caltrans' Standard Special Provisions on the Internet are available in either metric or English units.

7.7 CONSULTANT SELECTION

Local agencies that do hire consultants to do all or part of the seismic design shall follow the consultant selection procedures in Chapter 10, "Consultant Selection", of the *Local Assistance Procedures Manual*.

It is recommended that 10% of the funds authorized for preliminary engineering be retained for the construction phase and the consultant contract written so that the consultant will be able to answer questions about the design during construction and to assist on change orders.

7.8 MANDATORY FIELD REVIEWS

PURPOSE/OBJECTIVE

Contrary to what is mentioned in Chapter 7 “Field Review” of the *Local Assistance Procedures Manual*, the objective of a seismic project field review are:

- Begin to scope the project (project not fully scoped until after the strategy meeting).
- Verify that the As-Built plans accurately represent the existing conditions.
- Check for modifications that would affect the seismic response of the structure.
- Dimension any members that are not accurately shown on the As-Built.
- If no As-Built available, measure and dimension all pertinent structural members.
- Check for new conditions that would be affected by construction work.
- Discuss environmental considerations.

The important checklist items to keep in mind for retrofit projects field review include:

Access	Clearance	Coordination	Detour
Environmental	Falsework	Obstructions	Utilities
Modifications	Hydraulics	Permits	

WHO ATTENDS

Note: on seismic retrofit projects the Field Review is mandatory. This is contrary to what is said in Chapter 7 “Field Review” of the *Local Assistance Procedures Manual*

Consultants (Structural, Geotechnical, Roadway, Environmental and/or anyone else that has been hired by Caltrans or the local agency).

Local Agency Staff knowledgeable of utilities, right of way, environmental, traffic, etc.

Caltrans contract manager for Caltrans consultant contracts (only when Caltrans is the lead agency for seismic design)

Caltrans Structures Local Assistance (only if time and resources permits)

District Local Assistance Staff (only if time and resources permits)

RESULTS/CONCLUSIONS

The scope of the project is determined

The existing conditions are verified and any modifications documented

Construction controls determined

Responsibilities are reviewed.

7.9 MANDATORY STRATEGY MEETING

PURPOSE/OBJECTIVE

As outlined in the Bridge Memo to Designers 20-4, the purpose and objectives of the strategy meetings are:

- Offer seismic designers support or alternative approaches.
- Determine that standard seismic retrofit details are being fully utilized.
- Establish alternative acceptable procedures to satisfy retrofits when unusual problems are encountered.
- Recommend alternative analysis when appropriate.
- Inform project engineer of solutions to similar problems done by Caltrans, consultants or other local agencies.
- Provide local agency personnel information for potential traffic control, right of way, utility, and environmental problems.
- Achieve consensus agreement on economical and practical retrofit strategies.

WHO SHOULD ATTEND

Those that should attend the strategy meeting are:

Design Consultants (Structural, Geotechnical and Traffic if necessary)

Local Agency Staff

Caltrans Division of Structures Staff - Office of Earthquake Engineering
 Office of Structures Design
 Office of Structures Construction
 Office of Structures Maintenance
 Office of Structural Foundations

Caltrans Structures Contract Manager or Structures Local Assistance Representative

PREPARATION FOR THE MEETING

The designer or project engineer should be expected to have done the diagnostics analysis using the appropriate static and dynamic analysis, summarized the condition of columns, restrainers/hinges and abutments, and have a proposed solution prior to scheduling a strategy meeting. The designers should be prepared to discuss at the meeting solutions considered and reasons for rejections of alternatives. At a minimum a General Plan employing a legend of retrofit work and location of work, along with a table outlining the controlling design ductility ratios should be presented. Additional tables and proposed details may also be necessary.

The local agency should be prepared to discuss the history of the bridge, environmental concerns, and any restrictions to construction such as traffic, right of way, environmental, etc.

MATERIALS REQUIRED FOR THE MEETING

Proposed Strategy Report, including General Plan, the bridge Sufficiency Rating from the Eligible Bridge List (see Chapter 6 "HBRR" in this manual, and estimate of costs (capital and engineering). This package (minimum 10 copies) should be delivered to the Structures Local Assistance Office in Sacramento two weeks prior to the scheduled strategy meeting.

As-Built Plans (full size if possible)

Photographs

Any plans or reports pertinent to proposed work (utility layout, right of way maps, etc.)

RESULTS/CONCLUSION

A general consensus to the acceptable analysis and retrofit approach should be reached by the strategy meeting attendees. Additional strategy meetings should not be necessary if all the information, mentioned above, is provided prior to and at the meeting. The conclusions reached should be outlined and summarized, by the agency responsible for seismic design, in a “strategy meeting minutes”, and incorporated into the Final Strategy Report. A copy of the minutes are sent to all attendees. OLP and a copy of the Final Strategy Report is kept on file in the Structures Local Assistance office.

7.10 PROCESSING PROCEDURES WHEN CALTRANS IS LEAD AGENCY

The overall processing procedures for developing local bridge retrofit projects under the seismic Safety Retrofit Program is shown in [Exhibit 7-A](#). The following discussion is a summary of the procedural steps involved.

Blocks of projects are identified for each lead agency for development based upon available funds and preliminary cost estimates. Project development activities vary somewhat depending upon which entity serves as the lead agency. In general structures are analyzed in priority order according to the rankings established by Caltrans’ screening.

CALTRANS RESPONSIBLE FOR SEISMIC DESIGN

1. Caltrans issues consultant task orders.
2. Caltrans initiates mandatory Field Review, see Section 7.8 Mandatory Field Review
 - Local agency that owns the bridge is required to attend.
 - Caltrans will give minimum 2-week notification.
 - Local agency begins work on Field Review form and Preliminary Environmental Study (PES), see Chapter 6 “Environmental Procedures” in the *Local Assistance Procedures Manual*. Note: the timing and paperwork required for this authorization is different than what is required in Chapter 3
 - Bridges to be included in program to be determined at field review
3. Local Agency submits “Request for Authorization” for preliminary engineering phase, see Chapter 3 “Project Authorization” in the *Local Assistance Procedures Manual*. Local agency can submit the request prior to the Field Review in order to be reimbursed for preparation before and attending the Field Review.
4. Caltrans completes initial structural analysis after Field Review.
5. Caltrans issues “Authorization to Proceed” to the local agency, see Chapter 3 “Project Authorization” in the *Local Assistance Procedures Manual*.
6. Local Agency begins preliminary environmental investigations and works closely with Caltrans to minimize impact on the environment, see Chapter 6 “Environmental Procedures” in the *Local Assistance Procedures Manual*
7. Caltrans schedules mandatory Strategy Meeting, see Section 7.9 Mandatory Strategy Meeting. All meetings will be held in Sacramento. (Local agency will be given 2-week notification and local agency travel costs are reimbursable.)

8. Local Agency completes Field Review form after the Strategy Meeting
9. OLP submits Program Supplement for preliminary engineering to local agency for execution.
10. Local Agency completes environmental documents per previous discussions and meetings.
11. Caltrans completes structural portion of PS&E and transmits to local agency.
12. Local agency completes roadway portion of PS&E and combines it with Caltrans PS&E portion. Caltrans will not review the combined PS&E. Local agency will certify the non-structural portion of the PS&E, see Chapter 12 “PS&E” in the *Local Assistance Procedures Manual*
13. Local agency submits “Request for Authorization” for construction and constructs project, see Chapter 3 “Project Authorization” in the *Local Assistance Procedures Manual*
 - “Authorization to Proceed” required before project is advertised.
 - OLP submits Program Supplement for construction to local agency for execution.
 - Program Supplement and PR2 have to be executed before a local agency can be reimbursed, see Chapter 4 “Agreements” in the *Local Assistance Procedures Manual*
 - Caltrans will not provide oversight of the construction project, Caltrans will verify project completion.

LOCAL AGENCY RESPONSIBLE FOR SEISMIC DESIGN

Procedures are the same as when Caltrans is responsible for Seismic Design, except that:

1. Local agency submits blanket “Request for Authorization” for preliminary engineering, see Chapter 3 “Project Authorization” in the *Local Assistance Procedures Manual*. Note: the timing and paperwork required for this authorization is different than what is required in Chapter 3.
 - Combines all bridges that the local agency will be responsible for into one “Request for Authorization”
 - Caltrans will verify that the project/funding is programmed in the FSTIP and the FSTIP has been approved by FHWA.
2. Caltrans issues blanket “Authorization to Proceed” and submits Program Supplement for preliminary engineering to local agency for execution.
3. If local agency will utilize consultants, see Section 7.7, Consultant Selection.
4. Local agency initiates mandatory Field Review.
 - Send out notification of Field Review 2-week prior with complete listing of bridges to be reviewed to all appropriate people, see Section 7.8 Mandatory Field Review.
 - Caltrans, District and Structures, will attend if staff time allows.
5. Local agency completes initial structural analysis and begins other preliminary studies, see Chapter 6 “Environmental Procedures” in the *Local Assistance Procedures Manual*
6. Local agency schedules mandatory Strategy Meeting with Caltrans Structures.
 - Local agency will give 2-week notification
 - All meetings will be held in Sacramento.
 - All local agency travel costs are reimbursable.
 - See Section 7.9, Mandatory Strategy Meeting.
7. Local agency completes structures and roadway PS&E.
 - Caltrans will not review the PS&E.
 - Local agency certifies the completed PS&E package, see Chapter 12 “PS&E” in the *Local Assistance Procedures Manual*

8. Local agency submits “Request for Authorization” for construction and constructs project, see Chapter 3 “Project Authorization” in the *Local Assistance Procedures Manual*
 - “Authorization to Proceed” required before project is advertised.
 - OLP submits Program Supplement for construction to local agency for execution.
 - Program Supplement and PR2 have to be executed before a local agency can be reimbursed, see Chapter 4 “Agreements” in the *Local Assistance Procedures Manual*
 - Caltrans will not provide oversight of the construction project, Caltrans will verify project completion.

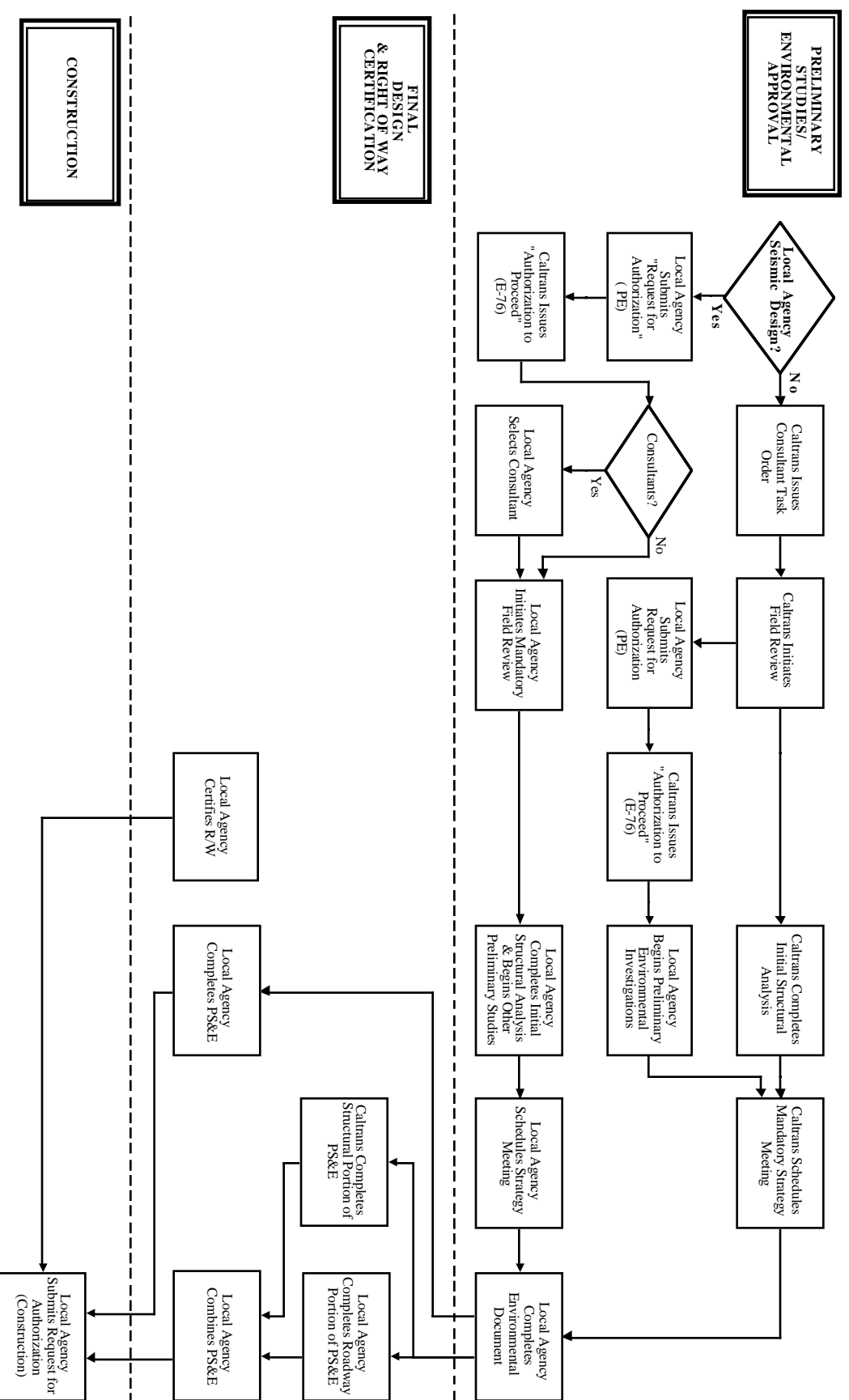
7.11 COORDINATION OF SEISMIC AND HBRR PROJECTS

Out of the 510 local agency bridges left in the seismic safety retrofit program, 70 are on the Bridge Replacement list and 95 are on the Bridge Rehabilitation list, see Chapter 6, HBRR, in this manual. Of the 165 bridges on either of the lists, 50 of the bridges already have HBRR funds reserved.

On the bridges the local agencies are responsible for, the local agency should carefully review the eligible bridge list before beginning any seismic analysis of the bridge. In some cases, Replacement or Rehabilitation (incorporating seismic considerations) may be the best alternative. Caltrans will be reviewing the list on those bridges where Caltrans is lead agency for seismic design. In some cases, replacement or rehabilitation (incorporating seismic considerations) may be the best alternative.

On combined HBRR and seismic projects, Caltrans will provide the State match for the local capital HBRR Funds up to the estimated seismic capital costs (right of way acquisition and construction contract costs). State will provide the match for all the support cost (preliminary engineering and construction engineering). Local agency will be required to provide match for HBRR capital funds to fund capital costs in excess of seismic retrofit capital costs.

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